Medical Science

25(112), June, 2021

Differences and similarities between COVID-19 and MERS-CoV: The prospect of co-immunization

To Cite:
Alotaibi A, Sogeir EKA, Bealy MABI, El-Hag AB. Differences and similarities between COVID-19 and MERS-CoV: The prospect of co-immunization. *Medical Science*, 2021, 25(112), 1372-1380

Author Affiliation:
[1]Department of Otolaryngology Head and Neck Surgery, College of Medicine, Hail of University, Saudi Arabia
[2]College of Medicine, University of Hail, Saudi Arabia
[3]Faculty of medical laboratory Science, University of Kordofan, El-Obeid, Sudan

✉**Corresponding author:**
Department of Otolaryngology Head and Neck Surgery, College of Medicine, Hail of University,
Saudi Arabia

Peer-Review History
Received: 04 May 2021
Reviewed & Revised: 05/May/2021 to 02/June/2021
Accepted: 03 June 2021
Published: June 2021

Peer-review Method
External peer-review was done through double-blind method.

Abdullah Alotaibi[1]✉, **Ehab Kamal Ahmed Sogeir**[2], **Mohamed Ahmed Babikir I Bealy**[2,3], **Amel B El Hag**[2]

ABSTRACT

Background: The nearby similarity of the coronaviruses (SARS-CoV, SARS-CoV-2, and MERS-CoV) intimating the possibility of shared immunization. Therefore, this study aimed to assess the differences and similarities between COVID-19 and MERS-CoV: the prospect of co-immunization. *Methodology*: This study included a cross-sectional random survey that recruited 211 contributors living in the city of Hail, Northern Saudi Arabia, during the period from April 2020 to March 2021. A purposeful electronic questionnaire was deliberated and distributed via various social media sets, regardless of age or gender. Information linked to previous MERS-CoV or COVID19 previous infection was collected. The study population included two groups. Group one: tested for MERS-CoV or COVID19 and found positive. *Results:* COVID19 and MERS-CoV infections were revealed in 28% and 27% of persons, respectively. Out of the 55 patients infected with MERS-CoV, 24/55(43.6%) were subsequently infected with COVID19. The risk of COVID19 infection associated with previous MERS-Cov infection, Odds Ratio (OR) and 95% confidence interval (95%CI), OR (95%CI) = 2.782(1.436-5.391), P-value = 0.002. Out of 21 persons with a family history of MERS-CoV, 7/21(33%) were subsequently infected with COVID19. *Conclusion*: Previous MERS-CoV infection does not precludelater COVID19 infection. People with previous MERS-CoV infection are more susceptible to COVID19 infection. Males and older individuals are more susceptible to be infected with COVID19 with severe clinical manifestations.

Keywords: COVID19, SARS-CoV, MERS-CoV, Saudi Arabia, Immunization

1. INTRODUCTION

The recent largest epidemic of COVID19 has afflicted the whole globe through the widespread, which caused significant public health crises worldwide. COVID19 is caused by the novel (SARS-CoV-2), which causes severe acute respiratory syndrome (SARS) (Izda et al., 2021). After its initial report in December 2019, COVID19 has vastly spread worldwide, causing millions of infections and millions of deaths in a short period (Park et al., 2021). Besides

major health issues, the COVID19 outbreak has afflicted most world communities psychologically, economically, and socially (Ahmed et al., 2020; Zakout et al., 2020).

Before COVID19 recent epidemic, the former Coronaviruses (SARS-CoV and MERS-CoV) occurred in China and Saudi Arabia. Including COVID19, these viruses belong to one family of Coronaviruses and share numerous similarities (Rabaan et al., 2020). These similarities inspire many researchers to think about immunization, the production of the vaccine, and therapeutic targets (Nascimento Junior et al., 2020). MERS-CoV was reported for the first time in Saudi Arabia in 2012, and the virus caused high morbidity and mortality following 2012, then the virus was reported in over 27 countries worldwide (Chafekar and Fielding, 2018). Based on the similarities of these viruses, we assumed the possibility of shared immunization and risk of infection. Therefore, the present study aimed to assess thedifferences and similarities between COVID-19 and MERS-CoV: the prospect of co-immunization.

2. MATERIALS AND METHODS

This study involved a cross-sectional random survey that recruited 211 participants living in the city of Hail, Northern Saudi Arabia, during the period from April 2020 to March 2021. A purposeful electronic questionnaire was premeditated and spread via different social media sets, irrespective of age or gender. In addition, information related to previous MERS-CoV or COVID19 previous infection was collected. The study population included two groups. Group one: tested for MERS-CoV or COVID19 and found positive. Group two: tested for MERS-CoV or COVID19 and found negative. Information related to camel contact (as a source of MERS-CoV infection) was also collected.

Statistical Analysis

The obtained information was first settled in an Excel sheet, then relocated to SPSS software for analysis to find out frequencies, percentages, means, odds ratios (OR), and statistically significant values. A Chi-square test was done (P-value <0.05 was considered statistically significant) considering a 95% confidence interval (95%CI).

Ethical Consent

The Ethical Committee approved the present research proposal at the College of Medicine, University Ha'il, Saudi Arabia. HREC00126/CM-UOH.04/20.

3. RESULTS

This study investigated 211 study subjects, aged 11-84 years with a mean age of 39 years. Gender was available for 201 participants, of whom 100/201(50%) were males, and 101/201(50%) were females. Most participants were aged 21-30 years, followed by 31-40, 51+, representing 61/201(30%), 54/201(27%), and 46/201(23%), respectively. Most males aged 21-30 years followed by 31-40 constituting 46/100(46%), and 16/100(16%), hence most females aged 31-40 years followed by 51+ constituting 38/101(38%), and 32/101(32%), in that order, as indicated in Table 1, Fig 1.

Table 1 Distribution of the study population by demographic characteristics

Category	Variable	Males	Females	Total
Age				
	<20 years	9	3	12
	21-30	46	15	61
	31-40	16	38	54
	41-50	15	13	28
	51+	14	32	46
	Total	100	101	201
Education				
	Basic	1	14	15
	Secondary	23	5	28
	University	71	84	155
	post-graduate	12	1	13
	Total	107	104	211
Nationality				

Saudi	103	102	205
Non-Saudi	3	2	5
Total	106	104	210

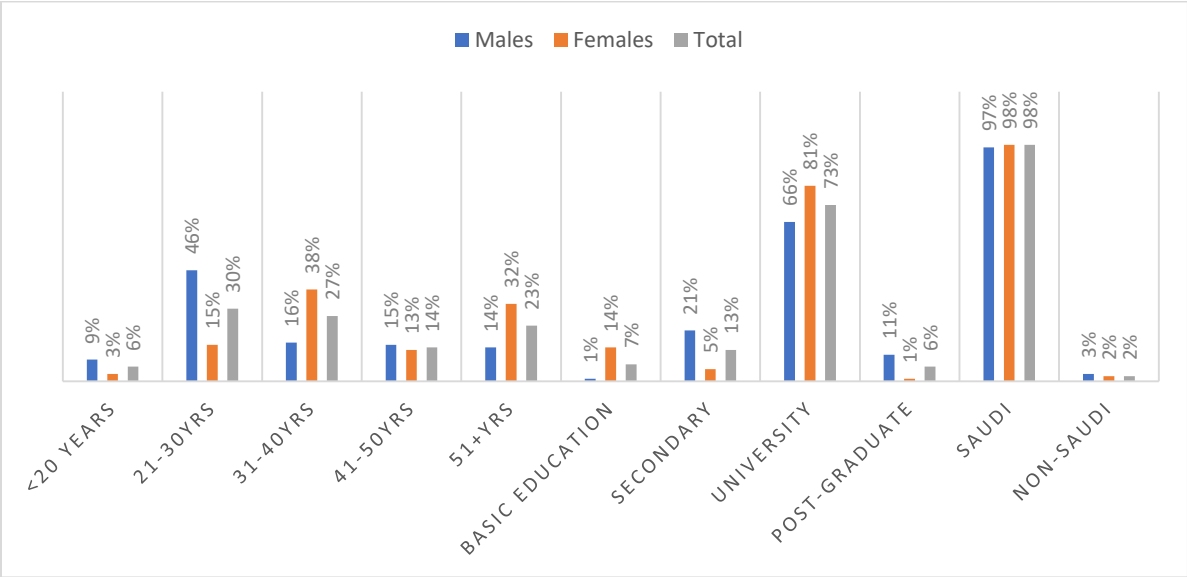

Figure 1 Description of participants by demographic characteristics

Table 2 Association between COVID19 and Mercov2 infection

Variable		COVID19 infected	Not infected	Total
MERS-CoV				
	Infected	24	31	55
	Not infected	32	115	147
	Total	56	146	202
History of family infection with MERS-CoV				
	Infected	7	14	21
	Not infected	46	125	171
	Total	53	139	192

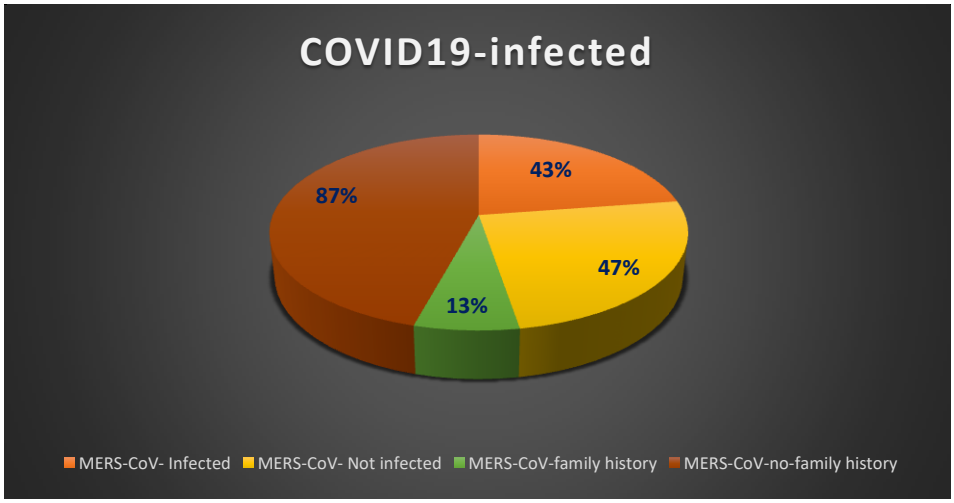

Figure 2 Association between COVID19 and Mercov2 infection

COVID19 and MERS-CoV infections were indicated in 56/202(28%) and 55/202(27%), respectively. Out of the 55 patients infected with MERS-CoV, 24/55(43.6%) were subsequently infected with COVID19. The risk of COVID19 infection associated with previous MERS-Cov infection, Odds Ratio (OR) and 95% confidence interval (95%CI), OR (95%CI) = 2.782(1.436-5.391), P-value = 0.002. Out of 21persons with a family history of MERS-CoV, 7/21(33%) were subsequently infected with COVID19. MERS-CoV's family history has no statistically significant risk associated with subsequent COVID19 infection, OR (95%CI) = 1.359(0.516-3.578), P-value = 0.3, as indicated in Table 2, Fig 2.

Table 3, Fig 3 summarized the Association between COVID19 severity and post-MERS-CoV infection. Out of 20 COVID19 hospitalized patients, 14/20(70%) have previous MERS-CoV infection. Out of 3 COVID19 patients who needed a fixed ventilator, 2/3(66.7%) have previous MERS-CoV infection. Out of 15 COVID19 patients who took oxygen, 9/15(60%) have previous MERS-CoV infection.All MERS-CoV infected patients (n=17) who were subsequently infected with COVID19 were hospitalized for more than two weeks. Out of the 9 MERS-CoV infected patients, 8/9(88.9%) were cured of COVID19.

Table 3 Association between COVID19 severity and post-MERS-CoV infection

Variable		MERS-CoV infected	Not infected	Total
Hospitalized with COVID19				
	Yes	14	6	20
	No	14	62	76
	Total	28	68	96
Needed fixed ventilator				
	Yes	2	1	3
	No	25	54	79
	Total	27	55	82
Took Oxygen				
	Yes	9	6	15
	No	18	58	76
	Total	27	64	91
Period of admission/week				
	No admission	0	5	5
	One week	0	1	1
	Two	14	33	47
	Three	2	8	10
	Four	1	0	1
	Total	17	47	64
Outcomes				
	Cured	8	38	46
	Died	1	2	3
	Total	9	40	49

The association between COVID19 infection and MERS-CoV infection sources (camels) was summarized in Table 4, Fig 4. About 53/56(95%), 31/56(55%), and 21/54(39%) of the COVID19 infected patients use to drink camel milk, drink fresh milk without pasteurization, and drink the milk at least once a month, in that order. Out of the 14 individuals who used to drink camel urine, only 1/14(7%) was infected with COVID19. The OR 1.313(1.105-1.559), P-value =0.06. Around 39/56(70%), and 9/56(16%) of those infected with COVID19 were used to regular eating of camel meat and liver, correspondingly.

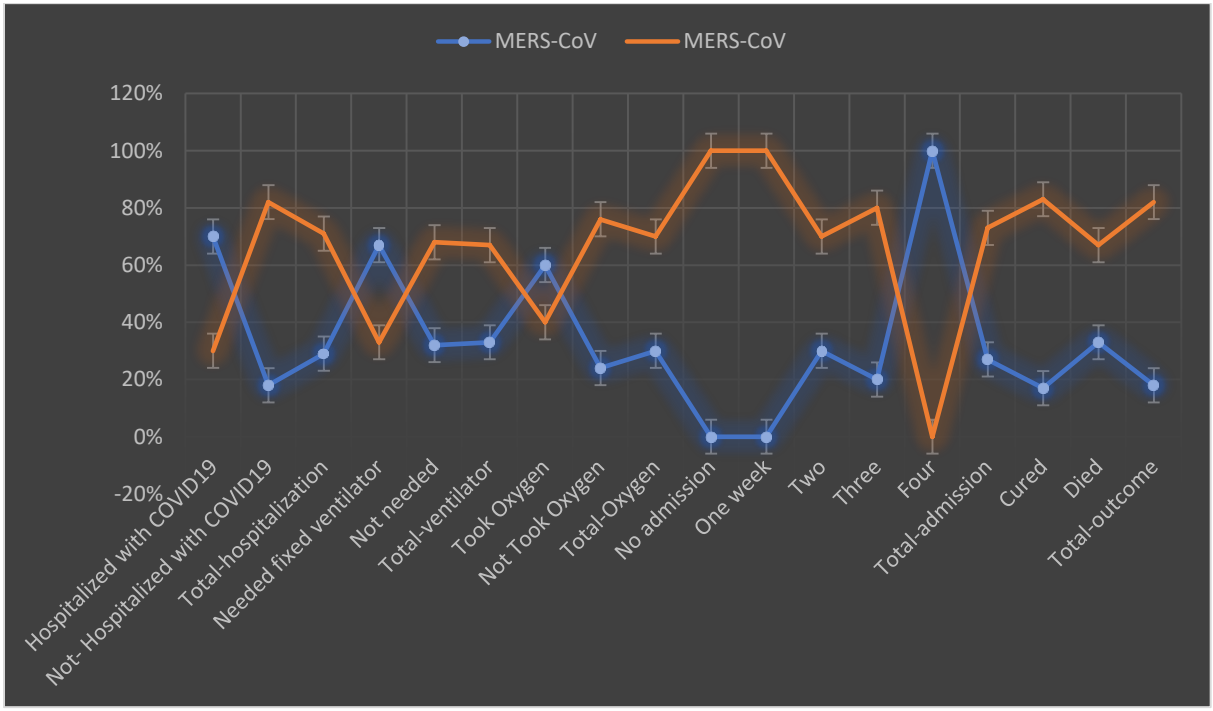

Figure 3 Association between COVID19 severity and post-MERS-CoV infection

Table 4 Association between COVID19 infection and MERS-CoV infection sources (camels)

Variable		COVID19		
		Infected	Not infected	Total
Camel milk drink				
	Yes	53	110	163
	No	3	36	39
	Total	56	146	202
Drink fresh without pasteurization				
	Yes	31	86	117
	No	25	60	85
	Total	56	146	202
Frequency of milk drink per month				
	Not drink	33	31	64
	once	11	80	91
	Twice	0	1	1
	More than 3 times	10	1	11
	Total	54	113	167
Camel urine drink				
	Yes	1	13	14
	No	55	133	188
	Total	56	146	202
Eat camel meat				
	Yes	39	115	154
	No	17	31	48
	Total	56	146	202
Eat camel meat liver				
	Yes	9	57	66
	No	47	89	136
	Total	56	146	202

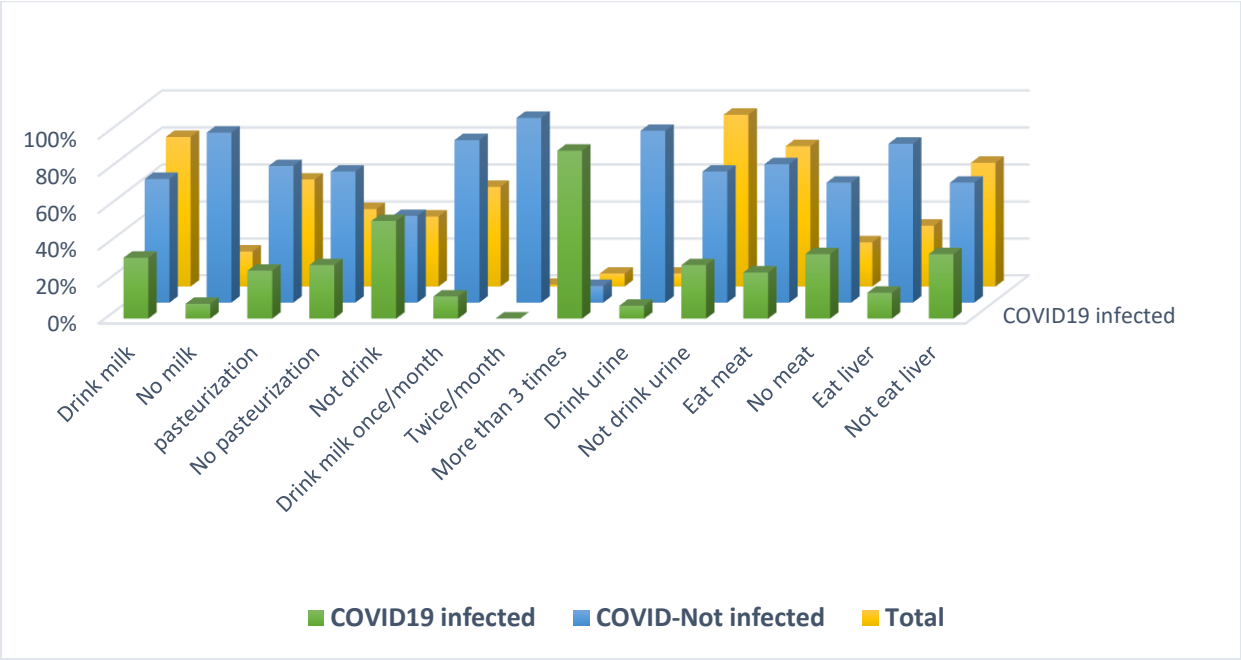

Figure 4 Association between COVID19 infection and MERS-CoV infection sources (camels)

Table 5, Fig 5 summarized the distribution of the study population by gender and age. Males (29%) were more frequent got infection with MERS-CoV than females (26%). OR (95%CI) = 1.06 (0.575-1.956), P-value = 0.4. Moreover, males (35%) were significantly got infection withCOVID19 than females (21%). OR (95%CI) = 1.86 (0.99-3.496), P-value = 0.03. MERS-CoV infection was more common age group 51+, followed by 31-40, and 21-30 years representing 21/50(42%), 12/50(24%), and 11/50(22%), respectively. On the other hand, COVID19 infection was more common age group 21-30, followed by 51+, and 31-40 years were representing 21/53(40%), 13/53(25%), and 11/53(21%), respectively.

Table 5 Distribution of the study population by gender and age

Variable	MERS-CoV			COVID19		
	Infected	Not infected	Total	Infected	Not infected	Total
Gender						
Males	29	77	106	35	69	104
Females	26	76	102	21	77	98
Total	55	153	209	56	146	202
Age						
<20 years	1	11	12	3	9	12
21-30	11	49	60	21	35	56
31-40	12	41	53	11	40	51
41-50	5	23	28	5	22	27
51+	21	25	46	13	33	46
Total	50	149	199	53	139	192

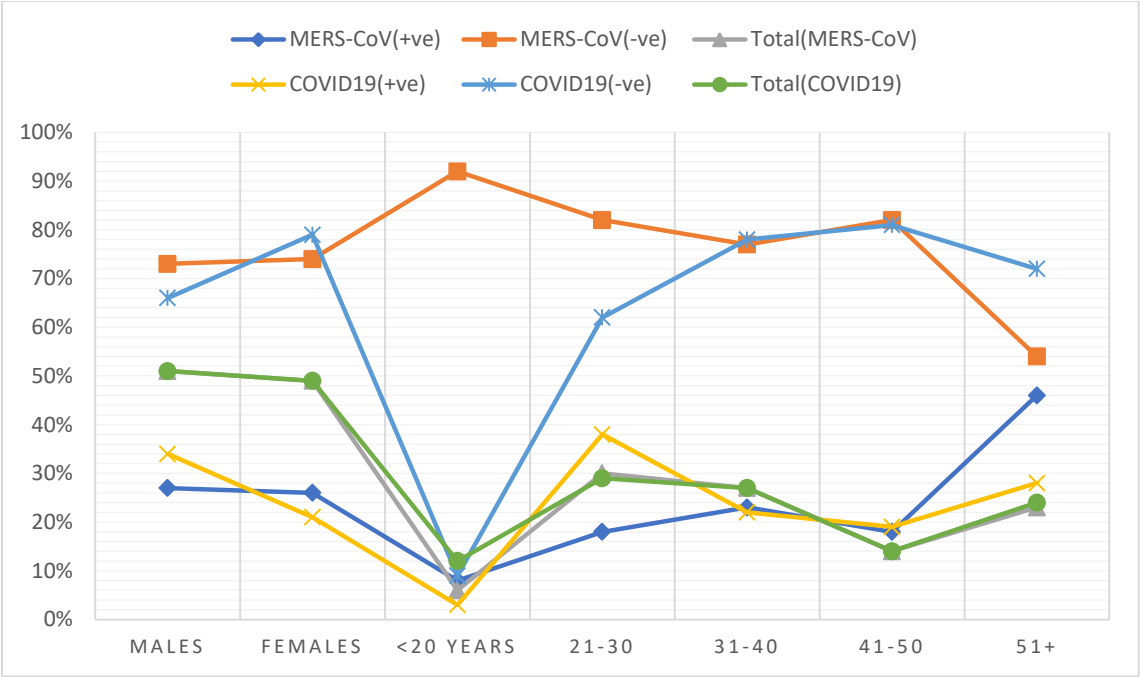

Figure 5 Description of the infection within gender and age entire groups

4. DISCUSSION

In recent decades, Saudi Arabia has witnessed a massive pandemic of both MERS-CoV and COVOD19 (Algaissi et al., 2020; Obied et al., 2020). As there is a similarity between coronaviruses (MERS-CoV and COVOD19), we assumed to find some sorts of immunization among previously MERS-CoV, infected individuals. However, the findings of the present study showed reverse association in this context. Many studies have shown COVID19 (SARS-CoV-2) has a similar structure to other coronaviruses except for the spike protein (S), which is a little dissimilar in COVID19 causing coronavirus. The existence of a furin-like cleavage location in COVID19 accelerates the S protein priming boosting its efficacy of spread compared to other coronaviruses (Rabaan et al., 2020). However, the MERS-CoV spike S glycoprotein may stimulate the body to produce immunization patterns that differ from that of COVID19 S protein, which some researchers suggested (Xu et al., 2019). Moreover, the increased risk of people infected with MERS-CoV being infected with COVID19 might be attributed to the presence of shared risk factors (Chou et al., 2020).

The findings of the current study showing that COVID19 clinical severity increased among post-MERS-CoV infected individuals. MERS-CoV previously infected persons may have a greater risk of being with increased age, obese, or smokers. These factors may render an individual more susceptible to severe clinical patterns associated with COVID19 (Dhochak et al., 2020). Although there is substantial scientific progress since SARS-CoV pandemic up to COVID19, there is still a need for further progress to enhance our understanding of the pathogenesis of these viruses to develop effective therapeutics targets. The results of this study showing variable links between COVID19, and camels contact and nutrient products. More than three different human coronaviruses were isolated from dromedary camels in Saudi Arabia. These viruses included a dominant MERS-CoV lineage that caused the outbreaks in the Middle East and South Korea (Su et al., 2016).

Our results are showing that males are more susceptible to COVID19 than females. Similar findings were previously reported, with the male's mortality ranging from 59%-75% of the total COVID19 deaths. The biological sex difference was suggested to have a relationship with angiotensin-converting enzyme 2 ACE2) which is the prime receptor utilized by SARS-CoV-2 to penetrate the cells (Bienvenu et al., 2020). ACE2 has a significant role in cardiovascular disease (CVD), serving as a protective mechanism by deactivating the renin-angiotensin system (RAS). Thus, sex differences in CVD and COVID19 may share similar mechanisms in innate immune response and RAS system. On the other hand, females possess an instant and forceful natural immune response with relatively lower ACE2 (Viveiros et al., 2021).

Our findings showing that COVID19 infection is more frequent with the increase of age. Such findings were largely reported attributing the high susceptibility of older-aged to COVID19 to several factors, including an elevated risk of chronic diseases, C-reactive protein level, and ACE2 level (Göker et al., 2020; Vakili et al., 2020; Zhang et al., 2021). Although the present study's findings may strongly influence some directions the future COVID19 research, it has some limitations, including its cross-sectional setting and self-disclosed infection status.

5. CONCLUSION

Previous MERS-CoV infection does not prevent subsequent COVID19 disease. Individuals with previous MERS-CoV infection are more susceptible to COVID19 infection. Males and older persons are more vulnerable to be infected with COVID19 with severe clinical manifestations. More focus is needed to explore the relationship between camels' products and susceptibility to infection with COVID19.

Acknowledgment

The author would like to thank Professor Hussain Gadelkarim Ahmed for revising this paper.

Funding

This study was funded by Scientific Research Deanship at the University of Ha'il, Saudi Arabia (grant number COVID-1914).

Conflict of interest

The authors declare that there are no conflicts of interests.

Ethical approval for human

All procedures performed in studies involving human participants were following the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards (Ethical approval number: HREC00126/CM-UOH.04/20.

Informed consent

Informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Ahmed HG, Abboh EAA, Abdalla RAH, Elhussein GMO. Association between socio-demographical characteristics, comorbidities, and anxiety burden during COVID-19 lockdown in Saudi Arabia. Medical Science 2020; 24(105), 3709-3716.
2. Algaissi AA, Alharbi NK, Hassanain M, Hashem AM. Preparedness, and response to COVID-19 in Saudi Arabia: Building on MERS experience. J Infect Public Health 2020; 13(6):834-838.
3. Bienvenu LA, Noonan J, Wang X, Peter K. Higher mortality of COVID-19 in males: sex differences in immune response and cardiovascular comorbidities. Cardiovasc Res 2020; 116(14):2197-2206.
4. Chafekar A, Fielding BC. MERS-CoV: Understanding the Latest Human Coronavirus Threat. Viruses 2018; 10(2):93.
5. Chou R, Dana T, Buckley DI, Selph S, Fu R, Totten AM. Epidemiology of and Risk Factors for Coronavirus Infection in Health Care Workers: A Living Rapid Review. Ann Intern Med 2020; 173(2):120-136.
6. Göker H, AladağKarakulak E, Demiroğlu H. The effects of blood group types on the risk of COVID-19 infection and its clinical outcome. Turk J Med Sci 2020; 50(4):679-683.
7. Izda V, Jeffries MA, Sawalha AH. COVID-19: A review of therapeutic strategies and vaccine candidates. Clin Immunol 2021; 222:108634.
8. Nascimento Junior JAC, Santos AM, Quintans-Júnior LJ, Walker CIB, Borges LP, Serafini MR. SARS, MERS and SARS-CoV-2 (COVID-19) treatment: a patent review. Expert Opin Ther Pat 2020; 30(8):567-579.
9. Obied DA, Alhamlan FS, Al-Qahtani AA, Al-Ahdal MN. Containment of COVID-19: the unprecedented response of Saudi Arabia. J Infect Dev Ctries 2020; 14(7):699-706.
10. Park KS, Sun X, Aikins ME, Moon JJ. Non-viral COVID-19 vaccine delivery systems. Adv Drug Deliv Rev 2021; 169:137-151.
11. Rabaan AA, Al-Ahmed SH, Haque S, Sah R, Tiwari R, Malik YS, Dhama K, Yatoo MI, Bonilla-Aldana DK, Rodriguez-Morales AJ. SARS-CoV-2, SARS-CoV, and MERS-COV: A comparative overview. Inez Med 2020; 28(2):174-184.
12. Rabaan AA, Al-Ahmed SH, Haque S, Sah R, Tiwari R, Malik YS, Dhama K, Yatoo MI, Bonilla-Aldana DK, Rodriguez-Morales AJ. SARS-CoV-2, SARS-CoV, and MERS-COV: A comparative overview. Inez Med 2020; 28(2):174-184.

13. Shock N, Singhal T, Kabra SK, Lodha R. Pathophysiology of COVID-19: Why Children Fare Better than Adults? Indian J Pediatr 2020; 87(7):537-546.
14. Su S, Wong G, Shi W, Liu J, Lai ACK, Zhou J, Liu W, Bi Y, Gao GF. Epidemiology, Genetic Recombination, and Pathogenesis of Coronaviruses. Trends Microbiol 2016; 24(6):490-502.
15. Vakili S, Savardashtaki A, Jamalnia S, Tabrizi R, Nematollahi MH, Jafarinia M, Akbari H. Laboratory Findings of COVID-19 Infection are Conflicting in Different Age Groups and Pregnant Women: A Literature Review. Arch Med Res 2020; 51(7):603-607.
16. Viveiros A, Rasmuson J, Vu J, Mulvagh SL, Yip CYY, Norris CM, Oudit GY. Sex differences in COVID-19: candidate pathways, genetics of ACE2, and sex hormones. Am J Physiol Heart Circ Physiol 2021; 320(1):H296-H304.
17. Xu J, Jia W, Wang P, Zhang S, Shi X, Wang X, Zhang L. Antibodies and vaccines against Middle East respiratory syndrome coronavirus. Emerg Microbes Infect 2019; 8(1):841-856.
18. Zakout YM, Alreshidi FS, Elsaid RM, Ahmed HG. The magnitude of COVID-19 related stress, anxiety and depression associated with intense mass media coverage in Saudi Arabia. AIMS Public Health 2020; 7(3):664-678.
19. Zhang Z, Guo L, Huang L, et al. Distinct disease severity between children and older adults with COVID-19: Impacts of ACE2 expression, distribution, and lung progenitor cells. Clin Infect Dis 2021; 3:ciaa1911.